Risk Mitigation in the Built Environment Via Large Scale Multiphysics Simulations

Rainald Löhner
Professor, Physics and Astronomy Department
Director, Center for Computational Fluid Dynamics
George Mason University

Abstract

Buildings and their occupants are constantly exposed to a variety of risks. These could be in the form of unforeseen or extreme loads (wind, snow, blast, pedestrian or seismic loads, hazardous materials), dispersion of hazardous materials (fire, smoke, ...) or pathogen transmission (e.g. via HVAC systems, pedestrian traffic).

Over the last decade, advances in high fidelity multiphysics solvers, high performance computing resources and a robust experimental campaign have produced significant advances and discoveries in this field.

The talk will center on some of these advances, in particular rogue wind loads, COV-19/spread of diseases in the built environment, pedestrian/crowd simulation, i.e. risk mitigation of extreme weather, health events and loads.

Algorithmic, implementational and practical issues will be considered, and an outlook into coupled problems with large disparity of timescales will be given.

Rainald Lohner Bio:

Rainald Löhner is the head of the center for computational fluid dynamics of the George Mason University.

He received an MSc in Mechanical Engineering from the Technische Universitaet Braunschweig, Germany, as well as a PhD and DSc in Civil Engineering from the University College of Swansea, Wales.

His areas of interest include numerical methods, solvers, grid generation, parallel computing, visualization, pre-processing, fluid-structure interaction, shape and process optimization and computational crowd dynamics.

His codes and methods have been applied in many fields, including aerodynamics or airplanes, cars and trains, hydrodynamics of ships, submarines and UAVs, shock-structure interaction, dispersion and pathogen analysis in urban areas and the built environment, haemodynamics of vascular diseases and pedestrian safety assessments.

He is the author of more than 800 articles covering the fields enumerated above, as well as a textbook on Applied CFD Techniques.